STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CONTRACT CHANGE ORDER MEMORANDUM

TO: Tony Anziano, Program Manager /	FILE: **E.A.** 04 - 0120F4
FROM: Darryl Schram, Senior TE	**CO-RTE-PM** SF-80-13.2/13.9
	FED. NO. No

CCO#: **330**	SUPPLEMENT#: **0**	Category Code: **CHPT**	CONTINGENCY BALANCE (incl. this change) **$62,161,147.22**
COST: **$1,000,000.00**	INCREASE ☑	DECREASE ☐	HEADQUARTERS APPROVAL REQUIRED? ☑ YES ☐ NO
SUPPLEMENTAL FUNDS PROVIDED: **$0.00**			IS THIS REQUEST IN ACCORDANCE WITH ENVIRONMENTAL DOCUMENTS? ☑ YES ☐ NO

CCO DESCRIPTION:
Pier E2 Post Tensioning

PROJECT DESCRIPTION:
CONSTRUCT SELF-ANCHORED SUSPENSION BRIDGE

Original Contract Time:	Time Adj. This Change:	Previously Approved CCO Time Adjustments:	Percentage Time Adjusted: (including this change)	Total # of Unreconciled Deferred Time CCO(s): (including this change)
2490 Day(s)	**0** Day(s)	**501** Day(s)	**20** %	**3**

THIS CHANGE ORDER PROVIDES FOR:

Furnishing, installing, stressing, and grouting post tensioning for Pier E2 Shear Keys S1 and S2 saddle anchorage.

Contract Plan Sheets 884R1 "Pier E2 Bearing Details No. 2" and 887R2 "Pier E2 Shear Key Details No. 1" identify the anchor bolts for the Pier E2 Shear Keys and Bearings as 76 mm A354 Grade BD Bolts. These plan sheets require the bolts to be tensioned to 0.70 Fu (70% of their ultimate strength). Special Provisions Sections 10-1.47 "Spherical Bushing Bearing (Pier E2)" and 10-1.50 "Shear Key (Pier E2)" provide the specification requirements for the anchor bolts. Both of these specifications refer you to Special Provisions Section 10-1.59 "Steel Structures" which in turn refers you to various ASTM specifications including ASTMs A123, A153, A143, A354, etc. which provide further specifications for the manufacture and testing of the anchor bolts and hardware. While these references provide for the final mechanical properties and processes for the manufacture of the bolts, they do not specifically require hydrogen embrittlement testing for the anchor bolts.

Within days after tensioning was performed, the anchor bolts in the shear keys directly below the Eastbound and Westbound Orthotropic Box Girder (OBG) structures (known as Shear Keys S1 and S2) began to fail. A total of 32 out of the 96 anchor bolts broke before the Department directed the Contractor to reduce the anchor bolt tension to prevent further failures. A forensic metallurgic examination was jointly performed with both the Contractor's and Materials Engineering and Testing Services' (METS) metallurgical experts. It was determined that while the failed bolts' material properties did meet the contract specifications, the hardness properties were at the upper limit and the ductility and toughness properties were at the lower limit. Taking this high end hardness and low end ductility into account and combining it with a high tensile stress (0.70 Fu) makes this material more susceptible to the effects of hydrogen cracking (also known as hydrogen embrittlement). The metallurgical examination indicated that the bolts were susceptible to hydrogen embrittlement due to a lack of uniformity in the microstructure of the rods.

The anchor bolts at Shear Keys S1 and S2 are uniquely different from the anchor bolts at the remaining shear keys and bearings (known as Shear Keys S3 and S4 and Bearings B1, B2, B3, and B4) in that they were manufactured in 2008 as opposed to the remaining ones in 2010. In addition, due to physical limitations the anchor bolts at Shear Keys S1 and S2 have their anchors fully cast into the Pier E2 cap and are not replaceable, as opposed to the remaining shear keys and bearings which are thru bolted and thus replaceable. As such, Shear Keys S1 and S2 will require an alternate anchorage solution.

Multiple change orders will be issued for the alternate shear key solution including:

- CCO 312 furnish replacements for rods removed for testing,
- CCO 313 procure long lead time materials,
- CCO 314 perform work to remove, replace and test sample rods,
- CCO 319 fabricate saddles,
- CCO 320 shim temporary bearings,
- CCO 325 perform concrete and rebar demolition,
- CCO 326 core drill for through-cap tendons,
- CCO 327 install temporary work platforms, falsework, and saddles,
- CCO 328 furnish and install reinforcing bars,
- CCO 329 place shear key concrete,
- CCO 330 furnish and install post tensioning, and
- CCO 331 plan sheets

This change order (CCO 330) will install post tensioning for the Pier E2 Shear Key S1 and S2 saddle anchorage to secure the saddles in place as required for the alternate anchorage solution.

The total cost of this change order is $1,000,000.00 force account, which can be financed from the contingency fund. A detailed cost analysis is on file.

No time adjustment is warranted as this change order does not affect the controlling operation.

The Toll Bridge Project Oversight Committee (TBPOC) initially (April 11, 2013) approved $4.3 million to continue work on the Shear Key S1 & S2 anchor rod replacement strategy solutions and to procure long lead time materials. The TBPOC revised this approval (May 9, 2013) to include all E2 shear key anchorage work within the approved $4.3 million funding. At the June 6, 2013 TBPOC meeting the TBPOC revised this approval to $7.5 million. At the July 10, 2013 TBPOC meeting the TBPOC further revised this approval to $18 million. CCO's 313, 319, 320, 325, 326, 327, 328, 329, and 330 are specific to this approval.

In addition, at the May 9th meeting the TBPOC also approved $1 million for the anchor rods test program. CCO's 312 and 314 are specific to this approval.

The SAS risk register is carrying the risk "Fabrication and Installation of a bracket to secure shear keys to Pier E2" in the range of $8M to $15M for the work related to fabricating and installing a retrofit to act in the place of the A354 Grade BD rods manufactured in 2008. The SAS risk register is also carrying the risk - "B/D Rods at the Bearings of Pier E2 & Misc Locations (2010)" in the range of $500K to $6.5M to test the remaining A354 Grade BD rods. Delays to bridge opening should they occur are not considered in these risks but are captured to the extent they were known in March 2013 in the risk "Schedule Delays to Seismic Safety Opening".

This change order has concurrence from William Casey (Supervising TE), Tony Anziano (Program Manager), Rich Foley (HQ Oversight), Wenyi Long (Bridge Design), Ken Brown (Maintenance), and Jing Chen (District Design).

CONCURRED BY:			
Construction Engineer:	William Casey, Sup TE	Date	5/30/13
Bridge Engineer:	CT Oversight, Wenyi Long, P.E.	Date	6/4/13
Project Engineer:	District Design, Jing Chen	Date	6/6/13
Project Manager:	TB Program Manager, Tony Anzian	Date	7/12/13
FHWA Rep.:		Date	
Environmental:		Date	
Other (specify):	HQ, Rich Foley	Date	6/4/13
Other (specify):	Struct. Maint, Ken Brown	Date	6/11/13
District Prior Approval By:		Date	
HQ (Issue Approve) By:		Date	
Resident Engineer's Signature:		Date	7-27-13 7-10-13

ESTIMATE OF COST

	THIS REQUEST	TOTAL TO DATE
ITEMS	$0.00	$0.00
FORCE ACCOUNT	$1,000,000.00	$1,000,000.00
AGREED PRICE	$0.00	$0.00
ADJUSTMENT	$0.00	$0.00
TOTAL	$1,000,000.00	$1,000,000.00

FEDERAL PARTICIPATION

☐ PARTICIPATING ☐ PARTICIPATING IN PART ☑ NONE
☐ NON-PARTICIPATING (MAINTENANCE) ☐ NON-PARTICIPATING

FEDERAL SEGREGATION (if more than one Funding Source or P.I.P. type)
☐ CCO FUNDED PER CONTRACT ☐ CCO FUNDED AS FOLLOWS

FEDERAL FUNDING SOURCE	PERCENT

STATE OF CALIFORNIA - DEPARTMENT OF TRANSPORTATION

CONTRACT CHANGE ORDER

Change Requested by: Engineer

CCO: 330 **Suppl. No. 0** **Contract No. 04 – 0120F4** **Road** SF-80-13.2/13.9 **FED. AID LOC.:**

To: **AMERICAN BRIDGE/FLUOR ENTERPRISES INC A JOINT VENTURE**

You are directed to make the following changes from the plans and specifications or do the following described work not included in the plans and specifications for this contract. ***NOTE: This change order is not effective until approved by the Engineer.***

Description of work to be done, estimate of quantities and prices to be paid. (Segregate between additional work at contract price, agreed price and force account.) Unless otherwise stated, rates for rental of equipment cover only such time as equipment is actually used and no allowance will be made for idle time. This last percentage shown is the net accumulated increase or decrease from the original quantity in the Engineer's Estimate.

Extra Work at Force Account:

As directed by the Engineer, furnish, install, stress, and grout post tensioning for Pier E2 saddle anchorage in accordance with Contract Change Order 331 "Pier E2 Plans."

Labor, equipment and material authorized by the Engineer, as necessary, will be paid in accordance with the provisions of Section 4-1.03D, "Extra Work" of the Standard Specifications and Section 5-1.24, "Force Account Payment" of the Special Provisions.

Estimated Cost of Extra Work at Force Account $1,000,000.00

Estimated Cost: Increase ☒ **Decrease** ☐ **$1,000,000.00**

By reason of this order the time of completion will be adjusted as follows: 0 Days

Submitted by

Signature	**Resident Engineer** William Casey, Supervising T.E.	**Date** 7-27-13

Approval Recommended by

Signature	**Program Manager** Tony Anziano, Program Manager	**Date** 7/29/13

Engineer Approval by

Signature	**Program Manager** Tony Anziano, Program Manager	**Date**

We the undersigned contractor, have given careful consideration to the change proposed and agree, if this proposal is approved, that we will provide all equipment, furnish the materials, except as otherwise be noted above, and perform all services necessary for the work above specified, and will accept as full payment therefor the prices shown above.

NOTE: If you, the contractor, do not sign acceptance of this order, your attention is directed to the requirements of the specifications as to proceeding with the ordered work and filing a written protest within the time therein specified.

Contractor Acceptance by

Signature	(Print name and title)	**Date**